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Space Weather can negatively impact civil aviation’s ability to navigate, communicate, and protect people and systems from radiation. Geomagnetic storms can create ionospheric disturbances causing inaccurate Global Positioning System (GPS)/Global Navigation Satellite System (GNSS) positioning of aircraft within the National Airspace System (NAS). These inaccuracies can affect commercial aircraft precision landing as well as high fidelity navigation of Unmanned Aircraft Systems (UAS) at all altitudes. A digitally-based, highly connected and distributed Info-Centric NAS (ICN), more reliant on space-based assets to operate, could be vulnerable to disruptions caused by solar storms. Radio blackouts caused by Solar Flares can block radio communications at multiple frequencies, thereby limiting frequencies available to aircraft for Air Traffic Control and Aeronautical Operational Control communication. These same energetic protons can penetrate deep into objects they collide with causing damage to biological DNA or electronic circuits putting people and avionics in high flying aircraft at risk to radiation exposure. Several models that assess and predict Solar Energetic Particle (SEP) event onset, duration, and severity may be utilized to improve aviation safety and efficiency during solar radiation events.

This paper will share assessment results summarizing potential NAS vulnerabilities to space weather, as currently operated and as it advances towards ICN, supporting more diverse and potentially susceptible commercial space, UAS, and Advanced Air Mobility (AAM) operations. This assessment will include investigations into potential vulnerabilities of precision operations reliant upon GPS/GNSS, of radiation effects on biologics and avionics in commercial flights, supersonic aircraft operations, and space tourism, and FAA and stakeholder decision-making preparedness and available space weather information that may be needed to mitigate civil aviation and aerospace operational impacts. It will also highlight what SEP models perform well with regards to important aviation parameters and where the models still need improvement.

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